

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR LETTERS PATENT

**Facilitating Annotation Creation and Notification Via
Electronic Mail**

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09396701.091599
665160.T0296E6

ATTORNEY'S DOCKET NO. MS1-388US

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6 7 **RELATED APPLICATIONS**

8 This application claims priority to U.S. Provisional Application No.
9 60/100,452, filed September 15, 1998, entitled "Annotations for Streaming Video
10 on the Web: System Design and Usage", to Anoop Gupta and David M. Barger.

11 12 **TECHNICAL FIELD**

13 This invention relates to networked client/server systems and to methods of
14 annotating multimedia content in such systems. More particularly, the invention
15 relates to creation and notification of new annotations via electronic mail.

16 17 **BACKGROUND OF THE INVENTION**

18 The advent of computers and their continued technological advancement
19 has revolutionized the manner in which people work and live. One such
20 advancement is that of multimedia presentations, where presentations that used to
21 be made in person (e.g., college lectures, workplace training sessions, etc.) can be
22 provided to a computer user as multimedia data (e.g., video, audio, text, and/or
23 animation data). Today, such presentations are primarily video and audio, but a
24 richer, broader digital media era is emerging. Multimedia presentations provide
25 many benefits, such as allowing the presentation data to be created at a single time

1 yet be presented to different users at different times and in different locations
2 throughout the world.

3 These multimedia presentations are provided to a user as synchronized
4 media. Synchronized media refers to multiple media objects that share a common
5 timeline. Video and audio are examples of synchronized media – each is a
6 separate data stream with its own data structure, but the two data streams are
7 played back in synchronization with each other. Virtually any media type can
8 have a timeline. For example, an image object can change like an animated .gif
9 file, text can change and move, and animation and digital effects can happen over
10 time. This concept of synchronizing multiple media types is gaining greater
11 meaning and currency with the emergence of more sophisticated media
12 composition frameworks implied by MPEG-4, Dynamic HTML, and other media
13 playback environments.

14 The term “streaming” is used to indicate that the data representing the
15 various media types is provided over a network to a client computer on a real-
16 time, as-needed basis, rather than being pre-delivered in its entirety before
17 playback. Thus, the client computer renders streaming data as it is received from a
18 network server, rather than waiting for an entire “file” to be delivered.

19 Multimedia presentations may also include “annotations” relating to the
20 multimedia presentation. An annotation is data (e.g., audio, text, video, etc.) that
21 corresponds to a multimedia presentation. Annotations can be added by anyone
22 with appropriate access rights to the annotation system. These annotations
23 typically correspond to a particular temporal location in the multimedia
24 presentation and can provide a replacement for much of the “in-person”
25 interaction or “classroom discussion” that is lost when the presentation is not made

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1 "in-person" or "live". As part of an annotation, a user can comment on a
2 particular point, to which another user (or lecturer/presenter) can respond in a
3 subsequent annotation. This process can continue, allowing a "classroom
4 discussion" to occur via these annotations.

5 However, in order to gain wide range acceptance of multimedia
6 presentations and the use of annotations with such presentations, a user-friendly
7 manner for interacting with the presentations should be available.

8 Additionally, it would be useful to be able to notify individuals when new
9 annotations are added. In some systems, the author or other "owner" of a
10 multimedia presentation can be notified by electronic mail (email) whenever
11 someone adds a new annotation to the presentation. However, there are several
12 problems with such systems. One such problem is that the author or creator of the
13 annotation has no control over (or perhaps even knowledge of) who is being
14 notified of the new annotation. Another problem is that in order for the
15 author/owner of the presentation to view the annotation or to access the
16 multimedia presentation, the author/owner must manually access the multimedia
17 presentation and manually locate the portion corresponding to the new annotation.

18 The invention described below addresses these and other disadvantages of
19 current annotations systems, facilitating annotation creation and notification via
20 email.

21 22 SUMMARY OF THE INVENTION

23 A network system includes a client computer that can present multimedia
24 content to a user and an annotation server that can transmit, to the client computer,
25 annotations for the multimedia content. Users are presented with annotations

1 generated by other users and can create their own annotations that can be
2 presented to others. Users can be notified of new annotations by electronic mail
3 (email), and can also create new annotations by email.

4 According to one aspect of the invention, a user creating a new annotation
5 can identify one or more other users that are to be notified, by email, of the new
6 annotation. Users to be notified by email can be identified manually by the
7 annotation author, or alternatively a default user(s) to be notified by email can be
8 associated with the media content. Additionally, group identifiers can be used to
9 identify groups of users to be notified of the new annotation by email.

10 According to another aspect of the invention, an email message notifying a
11 recipient of a new annotation also includes a user-selectable link for the temporal
12 segment of multimedia content corresponding to the annotation. Upon receipt of
13 the email message, the recipient can select the link and have the media server
14 present, to the user, the temporal segment of multimedia content that corresponds
15 to the annotation.

16 According to another aspect of the invention, a recipient of an email
17 message notifying the recipient of a new annotation can create another new
18 annotation by replying to the email message. The recipient can enter the new
19 annotation content and select the "reply" option from his or her electronic mail
20 application. Selection of the "reply" option sends the reply email message to the
21 annotation server, which creates another new annotation using the content entered
22 by the recipient.

23 According to another aspect of the invention, a new email message can be
24 generated that includes the content for a new annotation but that is not in response
25 to an email notification of a new annotation. This new email message includes the

1 content for the new annotation as well as information that can be used by the
2 annotation server to create a new annotation. Examples of such information
3 include the multimedia content to which the new annotation corresponds, and the
4 temporal range of the media content to which the new annotation corresponds.

5 According to another aspect of the invention, one or more annotations can
6 be created by forwarding an email thread to the annotation server. Upon receiving
7 an email thread, including multiple email messages that were forwarded or replied
8 to by various users, the annotation server creates a new annotation including all of
9 these email messages. Alternatively, a separate annotation for each email message
10 in the thread may be created.

11 **BRIEF DESCRIPTION OF THE DRAWINGS**

12 The present invention is illustrated by way of example and not limitation in
13 the figures of the accompanying drawings. The same numbers are used
14 throughout the figures to reference like components and/or features.

15 Fig. 1 shows a client/server network system and environment in accordance
16 with one embodiment of the invention.

17 Fig. 2 shows a general example of a computer that can be used as a client or
18 server in accordance with the invention.

19 Fig. 3 illustrates an exemplary annotation server and a client computer in
20 more detail.

21 Fig. 4 shows an exemplary structure for an annotation entry that is
22 maintained by an annotation server of Fig. 3.

23 Fig. 5 illustrates implicit annotation collections for annotations maintained
24 by an annotation server of Fig. 3.
25

1 Fig. 6 illustrates an annotation toolbar in accordance with one embodiment
2 of the invention.

3 Fig. 7 shows an "add new annotation" dialog box that allows a user to
4 create a new annotation.

5 Fig. 8 shows an example email message notification of a new annotation.

6 Fig. 9 shows an example email reply message including a new annotation.

7 Fig. 10 is a flowchart illustrating exemplary steps in accessing media
8 content from an email message in accordance with the invention.

9 Fig. 11 is an exemplary diagram illustrating the creation of an email thread.

10 Fig. 12 is a flowchart illustrating an exemplary process in adding new
11 annotations from an email message in accordance with the invention.

12 Fig. 13 is a diagrammatic illustration of a graphical user interface window
13 displaying annotations and corresponding media segments concurrently in
14 accordance with the invention.

15 **DETAILED DESCRIPTION**

16 **General Network Structure**

17
18 Fig. 1 shows a client/server network system and environment in accordance
19 with one embodiment of the invention. Generally, the system includes multiple
20 network server computers 10, 11, 12, and 13, and multiple (*n*) network client
21 computers 15. The computers communicate with each other over a data
22 communications network. The communications network in Fig. 1 comprises a
23 public network 16 such as the Internet. The data communications network might
24 also include, either in addition to or in place of the Internet, local-area networks
25 and/or private wide-area networks.

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1 Streaming media server computer 11 has access to streaming media content
2 in the form of different media streams. These media streams can be individual
3 media streams (e.g., audio, video, graphical, etc.), or alternatively can be
4 composite media streams including two or more of such individual streams. Some
5 media streams might be stored as files in a database or other file storage system,
6 while other media streams might be supplied to the server on a "live" basis from
7 other data source components through dedicated communications channels or
8 through the Internet itself.

9 There are various standards for streaming media content and composite
10 media streams. The "Advanced Streaming Format" (ASF) is an example of such a
11 standard, including both accepted versions of the standard and proposed standards
12 for future adoption. ASF specifies the way in which multimedia content is stored,
13 streamed, and presented by the tools, servers, and clients of various multimedia
14 vendors. Further details about ASF are available from Microsoft Corporation of
15 Redmond, Washington.

16 Annotation server 10 controls the storage of annotations and their provision
17 to client computers 15. The annotation server 10 manages the annotation meta
18 data store 18 and the annotation content store 17. The annotation server 10
19 communicates with the client computers 15 via any of a wide variety of known
20 protocols, such as the Hypertext Transfer Protocol (HTTP). The annotation server
21 10 can receive and provide annotations via direct contact with a client computer
22 15, or alternatively via electronic mail (email) via email server 13. The annotation
23 server 10 similarly communicates with the email server 13 via any of a wide
24 variety of known protocols, such as the Simple Mail Transfer Protocol (SMTP).

1 The annotations managed by annotation server 10 correspond to the
2 streaming media available from media server computer 11. In the discussions to
3 follow, the annotations are discussed as corresponding to streaming media.
4 However, it should be noted that the annotations can similarly correspond to "pre-
5 delivered" rather than streaming media, such as media previously stored at the
6 client computers 15 via the network 16, via removable magnetic or optical disks,
7 etc.

8 When a user of a client computer 15 accesses a web page containing
9 streaming media, a conventional web browser of the client computer 15 contacts
10 the web server 12 to request a Hypertext Markup Language (HTML) page. The
11 client-based browser also submits requests to the media server 11 for streaming
12 data, and the annotation server 10 for any annotations associated with the
13 streaming data. When a user of a client computer 15 desires to add or retrieve
14 annotations, the client computer 15 contacts the annotation server 10 to perform
15 the desired addition/retrieval.

16 17 **Exemplary Computer Environment**

18 In the discussion below, the invention will be described in the general
19 context of computer-executable instructions, such as program modules, being
20 executed by one or more conventional personal computers. Generally, program
21 modules include routines, programs, objects, components, data structures, etc. that
22 perform particular tasks or implement particular abstract data types. Moreover,
23 those skilled in the art will appreciate that the invention may be practiced with
24 other computer system configurations, including hand-held devices,
25 multiprocessor systems, microprocessor-based or programmable consumer

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1 electronics, network PCs, minicomputers, mainframe computers, and the like. In a
2 distributed computer environment, program modules may be located in both local
3 and remote memory storage devices.

4 Fig. 2 shows a general example of a computer 20 that can be used as a
5 client or server in accordance with the invention. Computer 20 is shown as an
6 example of a computer that can perform the functions of any of server computers
7 10-13 or a client computer 15 of Figure 1.

8 Computer 20 includes one or more processors or processing units 21, a
9 system memory 22, and a bus 23 that couples various system components
10 including the system memory 22 to processors 21.

11 The bus 23 represents one or more of any of several types of bus structures,
12 including a memory bus or memory controller, a peripheral bus, an accelerated
13 graphics port, and a processor or local bus using any of a variety of bus
14 architectures. The system memory includes read only memory (ROM) 24 and
15 random access memory (RAM) 25. A basic input/output system (BIOS) 26,
16 containing the basic routines that help to transfer information between elements
17 within computer 20, such as during start-up, is stored in ROM 24. Computer 20
18 further includes a hard disk drive 27 for reading from and writing to a hard disk,
19 not shown, a magnetic disk drive 28 for reading from and writing to a removable
20 magnetic disk 29, and an optical disk drive 30 for reading from or writing to a
21 removable optical disk 31 such as a CD ROM or other optical media. The hard
22 disk drive 27, magnetic disk drive 28, and optical disk drive 30 are connected to
23 the system bus 23 by an SCSI interface 32 or some other appropriate interface.
24 The drives and their associated computer-readable media provide nonvolatile
25 storage of computer readable instructions, data structures, program modules and

10

1 other data for computer 20. Although the exemplary environment described
2 herein employs a hard disk, a removable magnetic disk 29 and a removable optical
3 disk 31, it should be appreciated by those skilled in the art that other types of
4 computer readable media which can store data that is accessible by a computer,
5 such as magnetic cassettes, flash memory cards, digital video disks, random access
6 memories (RAMs) read only memories (ROM), and the like, may also be used in
7 the exemplary operating environment.

8 A number of program modules may be stored on the hard disk, magnetic
9 disk 29, optical disk 31, ROM 24, or RAM 25, including an operating system 35,
10 one or more application programs 36, other program modules 37, and program
11 data 38. A user may enter commands and information into computer 20 through
12 input devices such as keyboard 40 and pointing device 42. Other input devices
13 (not shown) may include a microphone, joystick, game pad, satellite dish, scanner,
14 or the like. These and other input devices are connected to the processing unit 21
15 through an interface 46 that is coupled to the system bus. A monitor 47 or other
16 type of display device is also connected to the system bus 23 via an interface, such
17 as a video adapter 48. In addition to the monitor, personal computers typically
18 include other peripheral output devices (not shown) such as speakers and printers.

19 Computer 20 operates in a networked environment using logical
20 connections to one or more remote computers, such as a remote computer 49. The
21 remote computer 49 may be another personal computer, a server, a router, a
22 network PC, a peer device or other common network node, and typically includes
23 many or all of the elements described above relative to computer 20, although only
24 a memory storage device 50 has been illustrated in Fig. 2. The logical connections
25 depicted in Fig. 2 include a local area network (LAN) 51 and a wide area network

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1 (WAN) 52. Such networking environments are commonplace in offices,
2 enterprise-wide computer networks, intranets, and the Internet. In the described
3 embodiment of the invention, remote computer 49 executes an Internet Web
4 browser program such as the "Internet Explorer" Web browser manufactured and
5 distributed by Microsoft Corporation of Redmond, Washington.

6 When used in a LAN networking environment, computer 20 is connected to
7 the local network 51 through a network interface or adapter 53. When used in a
8 WAN networking environment, computer 20 typically includes a modem 54 or
9 other means for establishing communications over the wide area network 52, such
10 as the Internet. The modem 54, which may be internal or external, is connected to
11 the system bus 23 via a serial port interface 33. In a networked environment,
12 program modules depicted relative to the personal computer 20, or portions
13 thereof, may be stored in the remote memory storage device. It will be
14 appreciated that the network connections shown are exemplary and other means of
15 establishing a communications link between the computers may be used.

16 Generally, the data processors of computer 20 are programmed by means of
17 instructions stored at different times in the various computer-readable storage
18 media of the computer. Programs and operating systems are typically distributed,
19 for example, on floppy disks or CD-ROMs. From there, they are installed or
20 loaded into the secondary memory of a computer. At execution, they are loaded at
21 least partially into the computer's primary electronic memory. The invention
22 described herein includes these and other various types of computer-readable
23 storage media when such media contain instructions or programs for implementing
24 the steps described below in conjunction with a microprocessor or other data
25 processor. The invention also includes the computer itself when programmed

1 according to the methods and techniques described below. Furthermore, certain
2 sub-components of the computer may be programmed to perform the functions
3 and steps described below. The invention includes such sub-components when
4 they are programmed as described. In addition, the invention described herein
5 includes data structures, described below, as embodied on various types of
6 memory media.

7 For purposes of illustration, programs and other executable program
8 components such as the operating system are illustrated herein as discrete blocks,
9 although it is recognized that such programs and components reside at various
10 times in different storage components of the computer, and are executed by the
11 data processor(s) of the computer.

12 13 Client/Server Relationship

14 Fig. 3 illustrates an exemplary annotation server and a client computer in
15 more detail. As noted above, generally, commands are formulated at client
16 computer 15 and forwarded to annotation server 10 via HTTP requests. In the
17 illustrated embodiment of Fig. 3, communication between client 15 and server 10
18 is performed via HTTP, using commands encoded as Uniform Resource Locators
19 (URLs) and data formatted as object linking and embedding (OLE) structured
20 storage documents, or alternatively using Extensible Markup Language (XML).

21 Client 15 includes an HTTP services (HttpSvcs) module 152, which
22 manages communication with server 10, and an annotation back end (ABE)
23 module 151, which translates user actions into commands destined for server 10.
24 A user interface (MMA) module 150 provides the user interface (UI) for a user to
25 add and select different annotations and be presented with the annotations.

According to one implementation, the user interface module 150 supports ActiveX controls that display an annotation interface for streaming video on the Web.

Client 15 also includes a web browser module 153, which provides a conventional web browsing interface and capabilities for the user to access various servers via network 16 of Fig. 1. Web browser 153 also provides the interface for a user to select particular media streams for presentation. The user can select which one of different versions of multimedia content he or she wishes to receive from media server 11 of Fig. 1. This selection can be direct (e.g., entry of a particular URL or selection of a “low resolution” option), or indirect (e.g., entry of a particular desired playback duration or an indication of system capabilities, such as “slow system” or “fast system”). Alternatively, other media presentation interfaces could be used.

Client 15 further includes an electronic mail (email) agent 154 and an email interface 155. Email agent 154 manages the generation, transmission, receipt, and storage of email messages at client 15. Email interface 155 provides the interface for a user to make use of the email services of email agent 154, including creating, modifying, deleting, responding to, etc. email messages. Email messages can be received by client 15 from other client computers or servers either directly or indirectly via an email server (e.g., email server 13 of Fig. 1). Additionally, new email messages, including replies to received email messages, can be forwarded to other client computers or servers on network 16 either directly or indirectly via an email server (e.g., email server 13). Any of a wide variety of conventional electronic mail protocols can be used by email agent 154 to send and receive email messages, such as SMTP.

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1 Annotation server 10 includes the Multimedia Annotation Web Server
2 (MAWS) module 130, which is an Internet Services Application Programming
3 Interface (ISAPI) plug-in for Internet Information Server (IIS) module 135.
4 Together, these two modules provide the web server functionality of annotation
5 server 10. Annotation server 10 also includes an HTTP Services module 131
6 which manages communication with client 15. In addition, annotation server 10
7 utilizes the Windows Messaging Subsystem 134 to facilitate communication with
8 email server 13 of Fig. 1, and an email reply server 133 for processing incoming
9 email received from email server 13.

10 Annotation server 10 further includes an annotation back end (ABE)
11 module 132, which contains functionality for accessing annotation stores 17 and
12 18, for composing outgoing email based on annotation data, and for processing
13 incoming email. Incoming email to annotation server 10 is received and passed to
14 the ABE module 132 by the Email Reply Server 133. If the incoming email
15 includes the necessary information to generate an annotation, email reply server
16 133 converts the email into an annotation and forwards the annotation to ABE 132
17 for adding to annotation stores 17 and 18. Annotation content authored at client
18 15, using user interface 150, is received by ABE 132 and maintained in annotation
19 content store 17. Received meta data (control information) corresponding to the
20 annotation content is maintained in annotation meta data store 18.

21 The annotation content and meta data can be stored in any of a variety of
22 conventional manners, such as in SQL relational databases (e.g., using Microsoft
23 "SQL Server" version 7.0, available from Microsoft Corporation). Annotation
24 server 10 is illustrated in Fig. 3 as maintaining the annotation content and
25 associated control information (meta data) separately in two different stores.

1 Alternatively, all of the annotation data (content and meta information) can be
2 stored together in a single store, or content may be stored by another distinct
3 storage system on the network 16 in Fig. 1, such as a file system, media server,
4 email server, or other data store.

5 6 Annotation Storage Structure

7 Fig. 4 shows an exemplary structure for an annotation entry 180 that is
8 maintained by annotation server 10 in annotation meta data store 18 of Fig. 3. In
9 the illustrated embodiment, an annotation entry 180 includes an author field 182, a
10 time range field 184, a time units field 186, a creation time field 188, a title field
11 190, a content field 192, an identifier field 194, a related annotation identifier field
12 196, a set identifier(s) field 198, a media content identifier field 200, and an
13 arbitrary number of user-defined property fields 202. Each of fields 182-202 is a
14 collection of data which define a particular characteristic of annotation entry 180.
15 Annotation entry 180 is maintained by annotation server 10 of Fig. 3 in annotation
16 meta data store 18. Content field 192, as discussed in more detail below, includes
17 a pointer to (or other identifier of) the annotation content, which in turn is stored in
18 annotation content store 17.

19 Author field 182 contains data identifying the user who created annotation
20 entry 180 and who is therefore the author of the annotation's content. The author
21 is identified by ABE 151 of Fig. 3 based on the user logged into client 15 at the
22 time the annotation is created, or alternatively by ABE 132 based on the sender of
23 an email message.

24 Time range field 184 contains data representing "begin" and "end" times
25 defining a segment of media timeline with which annotation entry 180 is

1 associated. Time units field 186 contains data representing the units of time
2 represented in time range field 184. Together, time range field 184 and time units
3 field 186 identify the relative time range of the annotation represented by
4 annotation entry 180. This relative time range corresponds to a particular segment
5 of the media stream to which annotation entry 180 is associated. The begin and
6 end times for the annotation are provided by the user via interface 150 of Fig. 3, or
7 alternatively can be automatically or implicitly derived using a variety of audio
8 and video signal processing techniques, such as sentence detection in audio
9 streams or video object tracking.

10 It should be noted that the time ranges for different annotations can overlap.
11 Thus, for example, a first annotation may correspond to a segment ranging
12 between the first and fourth minutes of a media stream, a second annotation may
13 correspond to a segment ranging between the second and seventh minutes of the
14 media stream, and a third annotation may correspond to a segment ranging
15 between the second and third minutes of the media stream.

16 Alternatively, rather than using the presentation timeline of the media
17 content, different media characteristics can be used to associate the annotation
18 with a particular segment(s) of the media content. For example, annotations could
19 be associated with (or "anchored" on) specific objects in the video content, or
20 specific events in the audio content.

21 Creation time field 188 contains data specifying the date and time at which
22 annotation entry 180 is created. It should be noted that the time of creation of
23 annotation entry 180 is absolute and is not relative to the video or audio content of
24 the media stream to which annotation entry 180 is associated. Accordingly, a user
25 can specify that annotations which are particularly old, e.g., created more than two

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1 weeks earlier, are not to be displayed. ABE 132 of Fig. 3 stores the creation time
2 and date when the annotation is created.

3 Title field 190 contains data representing a title by which the annotation
4 represented by annotation entry 180 is identified. The title is generally determined
5 by the user and the user enters the data representing the title using conventional
6 and well known user interface techniques. The data can be as simple as ASCII
7 text or as complex as HTML code which can include text having different fonts
8 and type styles, graphics including wallpaper, motion video images, audio, and
9 links to other multimedia documents.

10 Content field 192 contains data representing the substantive content of the
11 annotation as authored by the user. The actual data can be stored in content field
12 192, or alternatively content field 192 may store a pointer to (or other indicator of)
13 the content that is stored separately from the entry 180 itself. The user enters the
14 data representing the content using conventional and well known user interface
15 techniques. The content added by the user in creating annotation entry 180 can
16 include any one or more of text, graphics, video, audio, etc. or links thereto. In
17 essence, content field 192 contains data representing the substantive content the
18 user wishes to include with the presentation of the corresponding media stream at
19 the relative time range represented by time range field 184 and time units field
20 186.

21 Annotation identifier field 194 stores data that uniquely identifies
22 annotation entry 180, while related annotation identifier field 196 stores data that
23 uniquely identifies a related annotation. Annotation identifier field 194 can be
24 used by other annotation entries to associate such other annotation entries with
25 annotation entry 180. In this way, threads of discussion can develop in which a

1 second annotation responds to a first annotation, a third annotation responds to the
2 second annotation and so on. By way of example, an identifier of the first
3 annotation would be stored in related annotation identifier field 196 of the second
4 annotation, an identifier of the second annotation would be stored in related
5 annotation identifier field 196 of the third annotation, and so on.

6 Set identifier(s) field 198 stores data that identifies a particular one or more
7 sets to which annotation entry 180 belongs. A media stream can have multiple
8 sets of annotations, sets can span multiple media content, and a particular
9 annotation can correspond to one or more of these sets. Which set(s) an
10 annotation belongs to is identified by the author of the annotation. By way of
11 example, a media stream corresponding to a lecture may include the following
12 sets: "instructor's comments", "assistant's comments", "audio comments", "text
13 comments", "student questions", and each student's personal comments.

14 Media content identifier field 200 contains data that uniquely identifies
15 particular multimedia content as the content to which annotation entry 180
16 corresponds. Media content identifier 200 can identify a single media stream
17 (either an individual stream or a composite stream), or alternatively identify
18 multiple different streams that are different versions of the same media content.
19 Media content identifier 200 can identify media versions in a variety of different
20 manners. According to one embodiment, the data represents a real-time transport
21 protocol (RTP) address of the different media streams. An RTP address is a type
22 of uniform resource locator (URL) by which multimedia documents can be
23 identified in a network. According to an alternate embodiment, a unique identifier
24 is assigned to the content rather than to the individual media streams. According
25 to another alternate embodiment, a different unique identifier of the media streams

1 could be created by annotation server 10 of Fig. 3 and assigned to the media
2 streams. Such a unique identifier would also be used by streaming media server
3 11 of Fig. 1 to identify the media streams. According to another alternate
4 embodiment, a uniform resource name (URN) such as those described by K.
5 Sollins and L. Mosinter in "Functional Requirements for Uniform Resource
6 Names," IETF RFC 1733 (December 1994) could be used to identify the media
7 stream.

8 User-defined property fields 202 are one or more user-definable fields that
9 allow users to customize the annotation system. Examples of such additional
10 property fields include a "reference URL" property which contains the URL of a
11 web page used as reference material for the content of the annotation; a "help
12 URL" property containing the URL of a help page which can be accessed
13 concerning the content of the annotation; a "view script" property containing
14 JavaScript which is to be executed whenever the annotation is viewed; a "display
15 type" property, which gives the client user interface information about how the
16 annotation is to be displayed; etc.

17 Fig. 5 illustrates implicit annotation collections for annotations maintained
18 by annotation server 10 of Fig. 3. A collection of annotations refers to annotation
19 entries 180 of Fig. 4 that correspond to the same media stream(s), based on the
20 media content identifier 200. Annotation entries 180 can be viewed conceptually
21 as part of the same annotation collection if they have the same media content
22 identifiers 200, even though the annotation entries may not be stored together by
23 annotation server 10.

24 Annotation database 206 includes two annotation collections 208 and 210.
25 Annotation server 10 dynamically adds, deletes, and modifies annotation entries in

1 annotation database 206 based on commands from client 15. Annotation entries
2 can be created and added to annotation database 206 at any time a user cares to
3 comment upon the content of the stream (or another annotation) in the form of an
4 annotation. Annotation server 10 forms an annotation entry from identification
5 data, content data, title data, and author data of an "add annotation" request
6 received from the client's ABE 151 (Fig. 3), and adds the annotation entry to
7 annotation database 206.

8 Annotation database 206 includes a fields 212, 214, and 216 that specify
9 common characteristics of all annotation entries of database 206 or an annotation
10 collection 208 or 210. Alternatively, fields 212-216 can be included redundantly
11 in each annotation entry 180.

12 Creator field 212 contains data identifying the user who was responsible for
13 creating annotation database 206.

14 RTP address fields 214 and 216 contains data representing an RTP address
15 of the media content (e.g., the RTP addresses of each of the different streams
16 contained in version table 204) for the annotation collection. An RTP address
17 provides an alternative mechanism, in addition to the data in identifier field 200 of
18 Fig. 4, for associating the media content with annotation entries 180. In
19 alternative embodiments, RTP address fields 214 and 216 need not be included.
20

21 **Annotation Notification and Creation**

22 An annotation can be created by a user of any of the client computers 15 of
23 Fig. 1. As discussed above with reference to Fig. 3, client 15 includes an interface
24 module 150 that presents an interface to a user (e.g., a graphical user interface),
25 allowing a user to make requests of annotation server 10. In the illustrated

1 embodiment, a user can access annotation server 10 via an annotation toolbar
2 provided by interface 150.

3 Fig. 6 illustrates an annotation toolbar in accordance with one embodiment
4 of the invention. Annotation toolbar 240 includes various identifying information
5 and user-selectable options 242-254.

6 Selection of an exit or "X" button 242 causes interface 150 to terminate
7 display of the toolbar 240. A server identifier 244 identifies the annotation server
8 with which client 15 is currently configured to communicate (annotation server 10
9 of Fig. 1. in the illustrated embodiment).

10 Selection of a connection button 246 causes ABE 151 of Fig. 3 to establish
11 a connection with the annotation server identified by identifier 244. Selection of a
12 query button 248 causes interface module 150 to open a "query" dialog box, from
13 which a user can search for particular annotations. Selection of an add button 250
14 causes interface module 150 to open an "add new annotation" dialog box, from
15 which a user can create a new annotation.

16 Selection of a show annotations button 252 causes interface module 150 to
17 open a "view annotations" dialog box, from which a user can select particular
18 annotations for presentation.

19 Selection of a preferences button 254 causes interface 150 of Fig. 3 to open
20 a "preferences" dialog box, from which a user can specify various UI preferences,
21 such as an automatic server query refresh interval, or default query criteria values
22 to be persisted between sessions.

23 Fig. 7 shows an exemplary "add new annotation" dialog box 260 that
24 allows a user to create a new annotation. Dialog box 260 can be presented, for
25 example, in response to user selection of add button 250 of Fig. 6.

1 Dialog box 260 includes an annotation set identifier 262, a subject line 264,
2 and an email field 266. Annotation set identifier 262 allows the user to identify a
3 named set to which the new annotation will belong. This set can be a previously
4 defined set, or a new set being created by the user. Selection of the particular set
5 can be made from a drop-down menu activated by selection of icon 268, or
6 alternatively can be directly input by the user (e.g., typed in using an alphanumeric
7 keyboard). According to one embodiment of the invention, annotation server 10
8 of Fig. 3 supports read and write access controls, allowing the creator of the set to
9 identify which users are able to read and/or write to the annotation set. In this
10 embodiment, only those sets for which the user has write access can be entered as
11 set identifier 262. Alternatively, rather than (or in addition to) user selection of an
12 annotation set, one or more annotation sets may be inherently associated with
13 dialog box 260 (or toolbar 240 of Fig. 6) and thus implicitly selected for each new
14 annotation.

15 Subject line 264 allows the user to provide a short summary or title of the
16 annotation content. Although the subject line is illustrated as being text, it could
17 include any of a wide variety of characters, alphanumerics, graphics, etc. In the
18 illustrated embodiment, subject line 264 is stored in the title field 190 of the
19 annotation entry of Fig. 4.

20 Email field 266 allows the user to input the email address of a recipient of
21 the annotation. The email addresses indicated in field 266 are provided to ABE
22 132 of annotation server 10, which in turn generates an email message including
23 the newly created annotation and sends the email message to the recipient(s)
24 indicated in field 266 in addition to adding the annotation to the annotation
25

1 databases. Alternatively, the email message can be sent directly by client 15 of
2 Fig. 1, or by an intermediary server (such as email server 13 of Fig. 1).

3 Entries into email field 266 can be made on an individual or a "group"
4 basis. Individual email addresses can be entered directly by the user, or can be
5 selected from a pre-defined list. A list of available email addresses can be made
6 available in any of a variety of conventional manners, such as via a pull-down or
7 drop-down menu, a menu bar option, etc. A pre-defined list of email addresses
8 can be obtained from a variety of different sources. For example, email agent 154
9 of Fig. 3 may have an "address book" or similar listing of email addresses
10 programmed in by the user or other individuals.

11 In one implementation, user interface 150 of Fig. 1 can have a list of email
12 addresses associated with it, and/or the annotation set identified by set identifier
13 262 may have a list of email addresses associated with it. These email addresses
14 associated with either the user interface or the annotation set can be automatically
15 entered as "default" email addresses, or alternatively can be individually selected
16 by the user (e.g., via a pull-down or drop-down menu).

17 Additionally, a group identifier can be entered into email field 266 to
18 identify a group of email addresses. When the user adds an annotation with a
19 group identifier in email field 266, annotation backend 132 of Fig. 3 (or
20 alternatively another component, such as email server 13 of Fig. 1 or annotation
21 backend 151 of Fig. 3) forwards an email message of the new annotation to each
22 email address that corresponds to the group identifier. Group identifiers can be
23 defined to correspond to email addresses in any of a variety of manners. For
24 example, user interface 150 or the annotation set identified by set identifier 262
25

1 A time strip 282 is also provided as part of dialog box 260. Time strip 282
2 represents the entire presentation time of the corresponding media stream. A
3 "thumb" 283 that moves within time strip 282 indicates a particular temporal
4 position within the media stream. The annotation being created via dialog box 260
5 has a begin time and an end time, which together define a particular segment of
6 the media stream. This segment is illustrated as darkened portion 284 of time strip
7 282. When "from" button 286 is selected, thumb 283 represents the begin time for
8 the segment relative to the media stream. When "to" button 287 is selected, thumb
9 283 represents the end time for the segment relative to the media stream.
10 Alternatively, two different time bars could be displayed, one for the begin time
11 and one for the end time. The begin and end times are also displayed in an
12 hours/minutes/seconds format in boxes 288 and 289, respectively.

13 Thumb 283 can be moved along time strip 282 in any of a variety of
14 conventional manners. For example, a user can depress a button of a mouse (or
15 other cursor control device) while a pointer is "on top" of thumb 283 and move the
16 pointer along time strip 282, causing thumb 283 to move along with the pointer.
17 The appropriate begin or end time is then set when the mouse button is released.
18 Alternatively, the begin and end times can be set by entering (e.g., via an
19 alphanumeric keyboard) particular times in boxes 288 and 289.

20 Dialog box 260 also includes a "play" button 290. Selection of play button
21 290 causes interface module 150 of Fig. 3 to forward a segment specification to
22 web browser 153 of client 15. The segment specification includes the target
23 identifier from target display 280 and the begin and end times from boxes 288 and
24 289, respectively. Upon receipt of the segment specification from interface
25 module 150, the browser communicates with media server 11 and requests the

1 identified media segment using conventional HTTP requests. In response, media
2 server 11 streams the media segment to client 15 for presentation to the user. This
3 presentation allows, for example, the user to verify the portion of the media stream
4 to which his or her annotation will correspond.

5 Dialog box 260 also includes a cancel button 292, an OK button 294, and
6 an advanced button 296. Selection of cancel button 292 causes interface 150 to
7 close the dialog box 260, canceling out of the add new annotation process.
8 Selection of OK button 294 causes interface 150 to forward the information
9 entered in dialog box 260 to annotation backend 151, which sends the new
10 annotation information to annotation server 10 of Fig. 3. Interface 150 then closes
11 dialog box 260, the new annotation being entered.

12 Selection of "advanced" button 296 reduces the number of options
13 available to the user, simplifying dialog box 260. For example, the simplified
14 dialog box may not include fields and buttons 280 – 290.

15 As discussed above, when a new annotation is created, an email message is
16 created and sent to each email address identified in email field 266. The email
17 message is a notification to each of the email recipients (as identified by the email
18 addresses/groups in field 266) of the new annotation. Annotation back end 151 of
19 client 15 includes various identifying information for the annotation and its
20 corresponding media content. Some or all of this identifying information may be
21 made visible to the user, or alternatively may be embedded in header or footer
22 sections of the message that are not displayed to the user.

23 Fig. 8 shows an example email message notification of a new annotation.
24 Email interface 155 of Fig. 3 provides various conventional user-selectable
25 options 300 for viewing, creating, and manipulating electronic mail messages.

1 Host identifier 306 also identifies the temporal range or segment of the
2 media content with which the new annotation is associated. This temporal range is
3 the beginning and end time for the annotation, displayed in boxes 288 and 289 of
4 Fig. 7. When a user selects host identifier 306 in email message 302, the temporal
5 range information is forwarded to media server 11. Media server 11 then begins
6 streaming the media content to client 15, starting with the temporal location
7 identified by the begin time in host identifier 306. Media server 11 can then
8 continue to stream the remainder of the media content to client 15, or alternatively
9 may stream only the segment identified by the temporal range identifier (defined
10 by the begin and end time for the annotation).

11 Target identifier 308 (such as a uniform resource locator) identifies the
12 entire media content that the new annotation corresponds to. Target identifier 308
13 is the target identifier from target display 280 of Fig. 7, and is presented as a user-
14 selectable link to the media content (e.g., a text or graphic hyperlink). If the user
15 selects target identifier 308, email agent 154 of Fig. 3 forwards the URL of the
16 media content to annotation back end 151, which in turn accesses streaming media
17 server 11 of Fig. 1, as well as possibly annotation server 10 and web page server
18 12, to request the media content and begin playback of the media content to the
19 user.

20 Annotation identifier 310 uniquely identifies the new annotation. Identifier
21 310 is assigned by the annotation back end 132 of Fig. 3. Annotation identifier
22 310 can be used by annotation server 10 if the user selects to create another new
23 annotation by simply "replying" to the email message, as discussed in more detail
24 below. Annotation identifier 310 informs annotation server 10 of which
25 annotation the "reply" annotation corresponds to.

1 Annotation set identifier 312 indicates the annotation set(s) to which the
2 new annotation corresponds. Identifier 312 can be used by annotation server 10 if
3 the user selects to create another new annotation by replying to email message
4 302. Identifier 312 informs annotation server 10 which annotation set(s) the
5 "reply" annotation corresponds to.

6 Email message 302 also includes an installation option 314. Situations can
7 arise where the recipient of email message 302 does not have the necessary
8 modules (e.g., interface 150 and annotation backend 151 of Fig. 3) to present
9 annotations to a user concurrent with the corresponding multimedia content.
10 Installation option 314 is a user-selectable link (e.g., a text or graphic hyperlink),
11 that identifies an installation program (e.g., at annotation server 10). If the user
12 selects installation option 314, email agent 154 of Fig. 3 forwards the selected
13 URL to web browser 153, which in turn access the appropriate server (e.g.,
14 annotation server 10). The installation program can then run, installing the
15 appropriate modules on the client computer 15.

16 In addition to using email message 302 to play back annotations and/or
17 corresponding media content, the recipient of electronic mail message 302 can
18 also create an additional annotation by "replying" to message 302. This "reply" is
19 generated by user selection of the conventional "reply to sender" or "reply" option
20 provided by email interface 155, which is typically available in conventional email
21 user interfaces, such as "reply" button 316. When the user selects to reply, the
22 sender 318 of the original email message (annotation server 10) is entered as the
23 recipient of the reply message. The user can then enter in a new annotation via the
24 email interface 155 (which can be text, audio, video, or any media format
25 supported by the email interface 155 and agent 154). When the user finishes

1 entering the additional annotation, the user selects the "send" option which
2 forwards the reply message to annotation server 10. Annotation server 10 stores
3 this additional annotation, creating an annotation entry 180 of Fig. 3 for the new
4 annotation. In the illustrated embodiment, this new annotation identifies, in the
5 related annotation identifier field 196 of Fig 5, the original annotation that was
6 created when the original email message was sent by annotation server 10.

7 Fig. 9 shows an example email reply message including a new annotation.
8 Email reply message 332 includes the content 304 of the original annotation (e.g.,
9 the text, audio, video, etc.), as well as the identifiers 306-314 of the original
10 annotation. Reply message 332 further includes additional new content 334 for
11 another new annotation. When the user selects "send" button 336, the reply
12 message 332 is forwarded to annotation server 10.

13 Upon receipt of electronic mail reply message 332, annotation server 10
14 creates another new annotation and uses the reply message content 334 as the
15 content for this new annotation. The author of the new annotation is the sender of
16 reply message 332. Annotation server 10 uses identifiers 306-312 describing the
17 original annotation (from email message 302 of Fig. 8) as needed to create a new
18 annotation entry 180 of Fig. 4. Annotation server 10 associates this new
19 annotation with the same media content as the annotation in the original email (as
20 identified by target identifier 308 and host identifier 306 of Fig. 8). Annotation
21 server 10 also associates this new annotation with the same temporal range as the
22 annotation in the original email (as identified by host identifier 306 of Fig. 8).
23 Annotation server 10 further identifies, as a related annotation, the original
24 annotation that was created when the original mail message was sent by annotation
25 server 10 (as identified by annotation identifier 310 of Fig. 8). Annotation server

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1 10 also associates the new annotation with the same annotation set(s) as the
2 original annotation message (as identified by annotation set identifier 312 of Fig.
3 8).

4 Alternatively, annotation server 10 may obtain the annotation identifier of
5 the original annotation from the reply message 332 and access the annotation entry
6 180 of Fig. 4 with that identifier. Information from that annotation entry is then
7 used to create the new entry (e.g., fields 184-190, 196, and 198 of Fig. 4 are
8 copied to the new annotation entry).

9 In the illustrated examples of Figs. 8 and 9, various identifiers 306-314 are
10 presented to the user. Alternatively, one or more of these identifiers may be
11 included in the email messages but hidden from view. For example, one or more
12 "hidden" or "invisible" properties or parameters may be included in the email
13 message which are accessible by email agent 154 but are not displayed to the user.

14 Fig. 10 is a flowchart illustrating exemplary steps in accessing media
15 content from an email message in accordance with the invention. The steps on the
16 left side of Fig. 10 are implemented by client computer 15 of Fig. 1, and the steps
17 on the right side of Fig. 10 are implemented by streaming media server computer
18 11. The steps of Fig. 10, on both client and server computers, may be performed
19 in software. Fig. 10 is described with additional reference to components in Fig.
20 1.

21 An email message notification of a new annotation is received at the client
22 (step 352). This email message notification of the new annotation includes the
23 content of the new annotation, an URL of the corresponding media content, a
24 temporal range identifier for the new annotation, and an identifier of the
25

1 annotation. The client displays the email message via email interface 155,
2 including a user-selectable identifier of the media content (step 354).

3 In the illustrated example of Fig. 10, assume that the user selects the
4 identifier of the media content. The user-selection of the identifier is received by
5 the client (step 356), which in turn sends a request for the media content to the
6 streaming media server (step 358). The request for media content includes the
7 temporal range identifier that identifies the segment of the media content that the
8 annotation corresponds.

9 The request for media content, including temporal range information, is
10 received by the media server (step 360). The media server then begins streaming
11 the requested media content to the client, beginning with the starting point of the
12 segment identified by the temporal range information (step 362). The streaming
13 media content is received by and presented by the client (step 364).

14 In addition, other types of email messages that are not direct replies to an
15 email notification message can be used to add new annotations. Typical email
16 applications provide a user with a "forward" option that allows the user to send a
17 received email message to one or more other users, optionally appending an
18 additional message by the user. Such email messages can be forwarded from user
19 to user, creating a string of email messages often referred to as an "email thread".
20 Such forwarding can be found in numerous settings, such as system designers that
21 carry on "conversations" or discuss various options with one another via such
22 email messages. Thus, an original annotation notification email message can be
23 forwarded around to multiple additional users. The annotation server, however, is
24 not aware of such additional messages in an email thread unless the annotation
25 server is listed as a recipient of the messages (due to either replying to or

1 forwarding of a message). If one of the users forwarding the email thread,
2 however, were to forward the thread to the annotation server, then all of the email
3 messages in the thread so far could be added as annotations.

4 Fig. 11 is an exemplary diagram illustrating the creation of an email thread.
5 Initially, an email notification message 372 of a new annotation is sent from the
6 annotation server to user A. Upon receipt of the message 372, user A comments
7 on the new annotation and forwards it to user B. User B thus receives an email
8 message 374 including the content of the original email notification message 372
9 as well as the additional content 376 added by user A. User B similarly comments
10 on the new annotation and the comments of user A and forwards the email
11 message to User C. User C thus receives an email message 378 including the
12 content of the original email notification message 372, the additional content 376
13 added by user A, and the additional content 380 added by user B. User C can
14 similarly add additional content to the email message thread, and forward a
15 message 382 including the original email notification message 372, the additional
16 content 376 added by user A, the additional content 380 added by user B, and the
17 additional content 384 added by user C.

18 Upon receipt of the email message 382, user A can decide to forward the
19 message 382 to annotation server 10 of Fig. 3. By forwarding the message 382,
20 which is an email thread including multiple email messages from multiple users,
21 annotation server 10 can add the email messages from the thread into one or more
22 annotations. Thus, even though some of the email messages were not forwarded
23 to annotation server 10, they can subsequently be added to annotations.

24 When annotation server 10 receives an email thread such as message 382, it
25 generates one or more annotations based on the identifying information in the

1 thread. As the original email message 372 was an annotation notification email
2 message, message 372 includes identifying information for the original annotation,
3 including media content identifier and temporal range identifier. This identifying
4 information is used for all additional annotations that are created from message
5 382.

6 Annotation server 10 analyzes the message 382 and determines the portion
7 that was not part of the original annotation notification email message 372, and
8 creates an additional annotation for this portion. Alternatively, annotation server
9 10 may use all of message 382 to create a single annotation. In another alternative
10 implementation, annotation server analyzes the message 382 to identify each
11 individual addition to the original email notification message (based, for example,
12 on header information in each message) and creates a separate annotation for each
13 addition. Other alternative implementations may also be used, such as grouping
14 additions by the same user into the same annotation, etc.

15 The forwarding of messages illustrated in Fig. 11 can occur with any time
16 delays between forwardings. For example, user A may forward message 374 to
17 user B two minutes or two years after receiving the email notification message
18 372.

19 Additionally, a user may generate new annotations from email messages
20 that are not a reply to or forwarding of another email message. In order to
21 generate such an annotation, sufficient information needs to be included in the
22 email message to allow annotation server 10 to generate the annotation.
23 Specifically, identifying information of the media content to which the annotation
24 corresponds needs to be identified to annotation server 10. Additional information
25

1 may also optionally be required, such as a temporal range identification for the
2 annotation and annotation set identification.

3 This information can be included in the email message in a variety of
4 manners. In one implementation, the information is manually put into the message
5 by the user, such as by input from a keyboard or by using a "cut and paste"
6 methodology. Alternatively, web page server 12 of Fig. 1 may provide the
7 multimedia player interface of Fig. 13, which may display as part of the interface
8 the necessary identifying information. One selection of the multimedia player
9 interface may be a "new annotation" form that can be selected by the user. The
10 web page server 12 includes, visible or invisible to the user, the necessary
11 identifying information for annotation server 10 to generate a new annotation.

12 In another alternative implementation, the email agent 154 of Fig. 3 may
13 communicate with the web page server 12 or streaming media server 11 to obtain
14 the necessary identifying information for annotation server 10 to generate the new
15 annotation.

16 Fig. 12 is a flowchart illustrating an exemplary process in adding new
17 annotations from an email message in accordance with the invention. The process
18 is implemented by annotation server 10 of Fig. 3, and may be performed in
19 software. Fig. 12 is described with additional reference to components in Fig. 3.

20 Initially, the annotation server receives an email message with annotation
21 content (step 402). The annotation server analyzes the email message and locates
22 the annotation data in the email message (step 404), generating at least one new
23 annotation from the annotation data in the email message (step 406). The number
24 of annotations generated can vary (e.g., depending on whether the email message
25 is an email thread).

The annotation server also locates identifying information for media content corresponding to the new annotation(s) (step 408). The identifying information includes both the media content identifier and the temporal range identifier. This identifying information is used for each new annotation created. The annotation server then adds these new annotation(s) to the annotation store (step 410).

Annotation and Media Segment Retrieval

Fig. 13 shows one implementation of a graphical user interface window 500 that concurrently displays annotations and corresponding media segments. This UI window 500 has an annotation screen 454, a media screen 456, and a toolbar 240.

Media screen 456 is the region of the UI within which the multimedia content is rendered. For video content, the video is displayed on screen 456. For non-visual content, screen 456 displays static or dynamic images representing the content. For audio content, for example, a dynamically changing frequency wave that represents an audio signal could be displayed in media screen 456.

Annotation screen 454 is the region of the UI within which the annotations are rendered. For video, graphical, and text annotations, the video, graphical, or text content of the annotation is displayed on screen 454. For non-visual content, screen 454 displays static or dynamic images representing the annotation content, such as the title or summary of the annotation, or a dynamically changing frequency wave in the case of audio content.

1 **Conclusion**

2 The invention described above provides for the creation and notification of
3 new annotations via electronic mail (email). A user, in creating a new annotation,
4 can identify one or more other users that are to receive an email notification of the
5 new annotation. Upon receiving such an email notification, the recipient(s) can
6 advantageously access, via a single user-selectable link, the temporal segment of
7 multimedia content corresponding to the new annotation. Furthermore, additional
8 annotations can advantageously be generated from email, by replying to an email
9 notification of a new annotation, by sending a new email message or by
10 forwarding an email message or email thread, etc.

11 Although the invention has been described in language specific to structural
12 features and/or methodological steps, it is to be understood that the invention
13 defined in the appended claims is not necessarily limited to the specific features or
14 steps described. Rather, the specific features and steps are disclosed as preferred
15 forms of implementing the claimed invention.